Tutorial 1D model
LMDZ training course
17-18-19 th of december 2018

The primary aim of this tutorial is the installation and use of the 1D model that is associated with LMDz and its concurent use with the 3D model. There are two main differences between the 1D and 3D models: firstly, the 1D model is more « homemade » than the 3D one (it has been designed just for that and it's an ideal tool to fiddle with). Installing the model itself is done in a similar way than for the 3D model except that ***you have to install the 3D model before installing the 1D one.***

How to install the 1D model ?

cd ~LMDZ20181204.trunk
First step is to get the file 1D.tar.gz either with
wget http://www.lmd.jussieu.fr/~lmdz/Distrib/1D/1D.tar.gz (or LMDZ/1D directory on your hard disk)

tar xvzf 1D.tar.gz
cd 1D
./run.sh

Now, in ~LMDZ20181204.trunk, you have:

- 1D
- 1D.tar.gz
- install_lmdz.sh
- modipsl
- netcdf-4.0.1
- netcdf.log

The script should run smoothly without errors. If not, don't hesitate to ask for assistance.
While runing the script, which may take a few minutes, you'll see messages corresponding to the download of various elements or informational messages from the compiler.
The script ends with the execution of 6 test simulations: **dice_bucket arm_cu rico fire sandufast twpice** with one version of the physics : **NPv6.1**.

A all.pdf file is created with the results (rneb, large scale precipitation and convective precipitation) for all cases. You can visualize it with "**evince RESU/all.pdf** " and have a look at the results.

Look at the different physics versions: in ~LMDZ20181204.trunk/1D/INPUT/PHYS, you have a Readme file with the names of different physical packages and their specific features.
To visualize differencies between 2 physical packages, you can do for instance:

gvimd -d -O physiq.def_NPv3.2 physiq.def_NPv6.0.12split

For some cases (~/CAS/arm_cu, bomex, rico, fire, sandufast), you have LES.nc files which provide you LES results, considered as reference.

Test runs and analysis

1/ Make sensitivity tests about triggering of the deep convection scheme and switch from deterministic to stochastic approach:

- in run.sh choose eq_rd_cv case with NPv6.1 physics
- modify config.def to get only histhf.nc file
- modify run.def to run the case during 15 days
- modify lmdz1d.def to impose a dry soil (qsol0=5.)
- run the case and save the results in eq_rd_cv_norandom (deterministic version)
- modify physiq.def to activate stochastic triggering (iflag_trig_bl=1) and save results in eq_rd_cv_random
- compare for both simulations cloud fraction, convective precipitation, heating due to thermal plumes, due to convection, same for dqcon and dqthe
- note that the structures of these variables are less regular in stochastic version than in the deterministic version

2/ **Stratocumulus and transition to cumulus:**

- in run.sh, choose 6 cases: rico arm_cu fire sanduslow sandufast sanduref with NPv6.1 physics
- in run.sh, choose to run with 95 levels (modify line 99)
- in 1D/INPUT/DEF/gcm1d.def, put day_step=288 (temporal time step=5minutes)
- in ~1D/run.sh (line 171) modify "gzip listing" into "gzip -f listing"
- in ~1D/INPUT/PHYS: duplicate physiq.def. NPv6.0.12split and create physiq.def_NPv6.0.12split0 (with fact_thermals_ed_dz=0.), physiq.def_NPv6.0.12split0.1 (with fact_thermals_ed_dz=0.1), physiq.def_NPv6.0.12split0.2 (with fact_thermals_ed_dz=0.2),
- run the model
- have a look at ~RESU/all.pdf and try to explain the differences between results